on the touch event. Conventionally, touch screens have only been capable of recognizing a single touch event even when the touch screen is touched at multiple points at the same time (e.g., averaging, masking, etc.). Unlike conventional touch screens, however, the touch screen **36** shown herein is configured to recognize multiple touch events that occur at different locations on the touch sensitive surface **38** of the touch screen **36** at the same time. That is, the touch screen **36** allows for multiple contact points T**1**-T**4** to be tracked simultaneously, i.e., if four objects are touching the touch screen, then the touch screen tracks all four objects. As shown, the touch screen **36** generates separate tracking signals S**1**-S**4** for each touch point T**1**-T**4** that occurs on the surface of the touch screen **36** at the same time. The number of recognizable touches may be about **15**. **15** touch points allows for all **10** fingers, two palms and **3** others.

[**0039**] The multiple touch events can be used separately or together to perform singular or multiple actions in the host device. When used separately, a first touch event may be used to perform a first action while a second touch event may be used to perform a second action that is different than the first action. The actions may for example include moving an object such as a cursor or pointer, scrolling or panning, adjusting control settings, opening a file or document, viewing a menu, making a selection, executing instructions, operating a peripheral device connected to the host device etc. When used together, first and second touch events may be used for performing one particular action. The particular action may for example include logging onto a computer or a computer network, permitting authorized individuals access to restricted areas of the computer or computer network, loading a user profile associated with a user's preferred arrangement of the computer desktop, permitting access to web content, launching a particular program, encrypting or decoding a message, and/or the like.

[**0040**] Recognizing multiple touch events is generally accomplished with a multipoint sensing arrangement. The multipoint sensing arrangement is capable of simultaneously detecting and monitoring touches and the magnitude of those touches at distinct points across the touch sensitive surface **38** of the touch screen **36**. The multipoint sensing arrangement generally provides a plurality of transparent sensor coordinates or nodes **42** that work independent of one another and that represent different points on the touch screen **36**. When plural objects are pressed against the touch screen **36**, one or more sensor coordinates are activated for each touch point as for example touch points Ti -T**4**. The sensor coordinates **42** associated with each touch point T**1**-T**4** produce the tracking signals S**1**-S**4**.

[**0041**] In one embodiment, the touch screen **36** includes a plurality of capacitance sensing nodes **42**. The capacitive sensing nodes may be widely varied. For example, the capacitive sensing nodes may be based on self capacitance or mutual capacitance. In self capacitance, the "self" capacitance of a single electrode is measured as for example relative to ground. In mutual capacitance, the mutual capcitance between at least first and second electrodes is measured. In either cases, each of the nodes **42** works independent of the other nodes **42** so as to produce simultaneously occurring signals representative of different points on the touch screen **36**.

[**0042**] In order to produce a transparent touch screen **36**, the capacitance sensing nodes **42** are formed with a transparent conductive medium such as indium tin oxide (ITO). In self capacitance sensing arrangements, the transparent conductive medium is patterned into spatially separated electrodes and traces. Each of the electrodes represents a different coordinate and the traces connect the electrodes to a capacitive sensing circuit. The coordinates may be associated with Cartesian coordinate system (x and y), Polar coordinate system (r, θ) or some other coordinate system. In a Cartesian coordinate system, the electrodes may be positioned in columns and rows so as to form a grid array with each electrode representing a different x, y coordinate. During operation, the capacitive sensing circuit monitors changes in capacitance that occur at each of the electrodes. The positions where changes occur and the magnitude of those changes are used to help recognize the multiple touch events. A change in capacitance typically occurs at an electrode when a user places an object such as a finger in close proximity to the electrode, i.e., the object steals charge thereby affecting the capacitance.

[**0043**] In mutual capacitance, the transparent conductive medium is patterned into a group of spatially separated lines formed on two different layers. Driving lines are formed on a first layer and sensing lines are formed on a second layer. Although separated by being on different layers, the sensing lines traverse, intersect or cut across the driving lines thereby forming a capacitive coupling node. The manner in which the sensing lines cut across the driving lines generally depends on the coordinate system used. For example, in a Cartesian coordinate system, the sensing lines are perpendicular to the driving lines thereby forming nodes with distinct x and y coordinates. Alternatively, in a polar coordinate system, the sensing lines may be concentric circles and the driving lines may be radially extending lines (or vice versa). The driving lines are connected to a voltage source and the sensing lines are connected to capacitive sensing circuit. During operation, a current is driven through one driving line at a time, and because of capacitive coupling, the current is carried through to the sensing lines at each of the nodes (e.g., intersection points). Furthermore, the sensing circuit monitors changes in capacitance that occurs at each of the nodes. The positions where changes occur and the magnitude of those changes are used to help recognize the multiple touch events. A change in capacitance typically occurs at a capacitive coupling node when a user places an object such as a finger in close proximity to the capacitive coupling node, i.e., the object steals charge thereby affecting the capacitance.

[**0044**] By way of example, the signals generated at the nodes **42** of the touch screen **36** may be used to produce an image of the touch screen plane at a particular point in time. Referring to **FIG. 3**, each object in contact with a touch sensitive surface **38** of the touch screen **36** produces a contact patch area **44**. Each of the contact patch areas **44** covers several nodes **42**. The covered nodes **42** detect surface contact while the remaining nodes **42** do not detect surface contact. As a result, a pixilated image of the touch screen plane can be formed. The signals for each contact patch area **44** may be grouped together to form individual images representative of the contact patch area **44**. The image of each contact patch area **44** may include high and low points based on the pressure at each point. The shape of the image as well as the high and low points within the image may be used to differentiate contact patch areas **44** that are in close proximity to one another. Furthermore, the